

AMENDMENTS TO THE CLAIMS

1-4. (Cancelled)

5. (Currently Amended) A method of forming a copper interconnection on a semiconductor device, said method comprising:

forming an auxiliary seed layer for reinforcing a copper seed layer in an interconnection groove defined in a surface of the semiconductor device using an electroless copper plating liquid containing dihydric copper ions, a complexing agent, and an aldehyde acid and ~~excluding alkaline metals and endocrine disruptors~~ an organic alkali; and

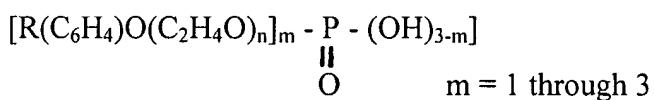
performing an electrolytic plating process using the seed layer including said auxiliary seed layer as a current feeding layer, for thereby filling copper in the interconnection groove defined in the surface of the semiconductor device.

provided that said method is conducted without any alkaline metals and endocrine disruptors.

6. (Original) A method of forming a copper interconnection according to claim 5, characterized by performing an electroless copper plating process at a plating rate of 50 nm/min. or less using said electroless copper plating liquid.

7. (Original) A method of forming a copper interconnection according to claim 5, characterized in that said electroless copper plating liquid contains polyoxyethylene alkylphenylether phosphoric acid and/or polyoxyethylene alkylphenylether, which has the structure indicated below, at a concentration ranging from 1 to 100 mg/L:

(polyoxyethylene alkylphenylether phosphoric acid)



(polyoxyethylene alkylphenylether)



8. (Original) A method of forming a copper interconnection according to claim 5, characterized in that said complexing agent comprises EDTA·4H (ethylenediaminetetraacetic acid),

said aldehyde acid comprises a glyoxylic acid, and said organic alkali comprises TMAH (tetramethylammonium hydroxide).

9. (Original) A method of forming a copper interconnection according to claim 8, characterized in that said copper ions have a concentration ranging from 0.01 to 10.0 g/L, said EDTA·4H has a concentration ranging from 0.5 to 100 g/L, said glyoxylic acid has a concentration ranging from 1 through 50 g/L, and the electroless copper plating liquid has a pH adjusted to a range from 10 to 14 by said TMAH.

10-17. (Cancelled)

18. (Currently amended) A method for forming copper interconnections within recesses in a surface of a semiconductor substrate, said method comprising:

providing a substrate with a copper seed layer within recesses in a surface of the semiconductor substrate;

forming an auxiliary copper seed layer for reinforcing the copper seed layer within the recesses using an electroless copper plating liquid ~~excluding alkaline metals and endocrine disruptors~~ at a plating rate of equal or less than 50nm/min; and

filling copper in the recesses by an electrolytic plating process using the reinforced copper seed layer as a current feeding layer,

provided that said method is conducted without any alkaline metals and endocrine disruptors.

19. (Previously presented) A method according to claim 18, wherein at least one of the recesses has an inlet size of less than 0.18 µm.

20. (Previously presented) A method according to claim 18, wherein said electroless copper plating liquid contains dihydric copper ions.

21. (Previously presented) A method according to claim 18, wherein said electroless copper plating liquid contains a complexing agent.

22. (Cancelled)

23. (Previously presented) A method according to claim 18, wherein said electroless copper plating liquid contains an organic alkali.

24. (Previously presented) A method according to claim 21, wherein said complexing agent comprises EDTA• 4H (ethylenediaminetetraacetic acid).

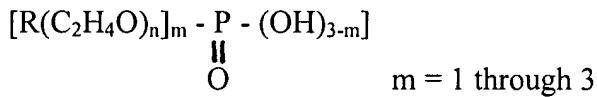
25. (Cancelled)

26. (Previously presented) A method according to claim 23, wherein said organic alkali comprises TMAH (tetramethylammonium hydroxide).

27. (Previously presented) A method according to claim 18, wherein said electroless copper plating liquid contains polyoxyethylene alkylether phosphoric acid and/or polyoxyethylene alkylether at a concentration ranging from 1 to 100 mg/L.

28. (Previously presented) A method according to claim 27, wherein said polyoxyethylene alkylether phosphoric acid and/or polyoxyethylene alkylether has a structure indicated below:

(polyoxyethylene alkylether phosphoric acid)



(polyoxyethylene alkylether)

$\text{RO}(C_2H_4O)_n\text{H}$.

29. (Previously presented) A method according to claim 20, wherein said copper ions have a concentration ranging from 0.01 to 10.0 g/L.

30. (Previously presented) A method according to claim 24, wherein said EDTA•4H has a concentration ranging from 0.5 to 100 g/L.

31. (Cancelled)

32. (Previously presented) A method according to claim 26, wherein the electroless copper plating liquid has a pH adjusted to a range from 10 to 14.

33. (Previously presented) A method according to claim 18, wherein said electroless copper plating liquid comprises an aldehyde acid as a reducing agent.

34. (Previously presented) A method according to claim 33, wherein said aldehyde acid comprises a glyoxylic acid.

35. (Previously presented) A method according to claim 34, wherein said glyoxylic acid has a concentration ranging from 1 through 50 g/L.